Graded Approach Implementation Procedure for Documented Safety Analyses for LLNL Nuclear Hazard Category 2 and 3 Facilities

April, 2002

Approved by: _____ _____

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Contents

1.0 Purpose

This procedure specifies the requirements, responsibilities, and methodology for applying the graded approach to all LLNL nuclear facilities, which are designated as Nuclear Hazard Category 2 or 3. The graded approach determines the level of detail of a Documented Safety Analysis (DSA) according to the risk of operation of the nuclear facility over its life cycle.

2.0 Scope

This procedure applies to the DSAs for all LLNL nuclear facilities and to the associated safety basis documents and their revisions. The document *Safety Basis Program Plan for Category 2 and 3 Nuclear Facilities* (see Reference 1 in Section 6.0) requires the use of this procedure. The methodology specified in this procedure meets the requirements of Title 10, Code of Federal Regulations, Part 830 (10 CFR 830; Reference 2). In applying the graded approach, LLNL usually follows the approved methodologies (referred to as the "safe harbor" methodologies) listed in Table 2 of Appendix A to Subpart B, 10 CFR 830. (This table is referred to in this procedure simply as "Table 2." See Section 7.1 for a reproduction of Table 2.)

In addition, this procedure follows the guidance in:

- Department of Energy (DOE) Standard (STD) 3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports (SAR)*, Change Notice 1 (Reference 3). (DOE-STD-3009-94 uses the term "SAR," which is one type of DSA. The broader term, "DSA," is used throughout this procedure.)
- DOE G 421.1-2, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR 830* (Reference 4).

Parts of this procedure can be applied to a graded approach based on DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans* (Reference 5), which is also an acceptable safe harbor methodology specified in 10 CFR 830 for nuclear facilities with a limited operational life.

3.0 Responsibilities

Because a DSA is prepared according to the graded approach, the graded approach is a part of the DSA process, and responsibilities for implementing the graded approach are linked with those for developing the DSA. Who executes the specific responsibilities depends on the facility and the level of staffing associated with the preparation of the DSA. The following responsibilities are an indication of who is to carry out the specific aspects of preparation of the DSA in accordance with the graded approach. Some of the roles and responsibilities described below may be performed by the same person, provided that the line of authority is preserved.

3.1 Facility Manager

The Facility Manager is responsible, among other activities identified elsewhere, for the following:

- Determination of the life cycle stage of the facility (based on the facility mission) and its communication to the DSA Leader.
- Ensuring that the DSA Leader receives the correct information for the application of the graded approach process in the development of the DSA.

3.2 Documented Safety Analysis Leader

The DSA Leader is accountable to the Facility Manager and is responsible for developing the DSA according to the graded approach process described in this procedure.

4.0 Graded Approach Requirements

This section specifies the requirements that apply to use of the graded approach in preparation of the DSA. Use of the graded approach in implementing the requirements of 10 CFR 830 is required by 10 CFR 830.7 (Graded Approach), which also requires that the basis of the graded approach used be documented and that the documentation be submitted to DOE. [The graded approach may not be used to implement the Unreviewed Safety Question (USQ) process or Technical Safety Requirements (TSRs).]

In accordance with 10 CFR 830.204 (Documented Safety Analysis), LLNL must obtain approval from DOE for the methodology used to prepare the DSA for a facility. However, prior approval is not required when using a safe harbor methodology specified in Table 2. This table specifies the DOE order or guidance document that must be followed (i.e., that contains the approved methodologies) for developing DSAs for various nuclear facilities. The methodology described in DOE-STD-3009-94 is the primary safe harbor methodology for Category 2 and 3 nuclear facilities.

In the DSA for a Category 3 nuclear facility, the methods described in Chapters 2, 3, 4, and 5 of DOE-STD-3009 (or successor document) may be used to address the following in a simplified fashion:

- The basic description of the facility (or activity) and its operation, including safety structures, systems, and components (SSCs).
- A qualitative hazards analysis.
- Hazard controls (consisting primarily of inventory limits and safety management programs) and their bases.

5.0 Using the Graded Approach

This section describes the use of the graded approach in preparation of a DSA.

5.1 Introduction

The graded approach is defined in 10 CFR 830.3 (Definitions) as the process of ensuring that the level of analysis, documentation, and actions used to comply with a requirement are commensurate with the following seven attributes:

1. The relative importance to safety, safeguards, and security.
2. The magnitude of any hazard involved.
3. The life cycle stage of a facility.
4. The programmatic mission of a facility.
5. The particular characteristics of a facility.
6. The relative importance of radiological and nonradiological hazards.
7. Any other relevant factor.

The above attributes determine the depth of analysis of a DSA. DOE-STD-3009-94 specifies only three of the above seven attributes (attributes 2, 3, and 5) for the graded approach but also provides some guidance for the application of attribute 6. The rule, orders, or standards referenced in this procedure provide no other specific guidance regarding the application of attributes 1, 4, or 7.

An example of graded approach guidance, DOE-STD-3009-94 cites DOE O 5480.23, which allows the magnitude of DSA preparation effort to be adjusted according to the following three facility attributes:

1. Facility hazard magnitude or severity.
2. Facility complexity.
3. Facility life cycle stage.

In other words, the DSA is developed based on judgment of the above three attributes of the facility. For example, the "facility life cycle stage" attribute indicates that a Category 3 facility or a facility with a short operational life may require a limited but adequate analysis documented to a level less than that required for a Category 2 facility.

5.2 Application of the Graded Approach to the Documented Safety Analysis

In applying the graded approach, LLNL may use the safe harbor methodologies specified in Table 2. The graded approach should consider the following:

- The facility hazard category designated according to Reference 6 (see Section 5.2.1).
- The facility life cycle stage, which is based on the facility mission.
- Complexity of facility operations and activities.

5.2.1 Facility Hazard Categorization

Application of the graded approach begins with determination of the facility hazard category, which must be based on an inventory of all radioactive materials in the facility using the methodology of DOE-STD-1027-92, Change Notice 1. The inventory is compared with the radioactive isotope thresholds specified in Table A.1 of DOE-STD-1027-92, with no modification and with adjustment only for segmentation, sealed sources, Department of Transportation (DOT) Type B containers with a current certificate of compliance, and airborne release fractions. Refer to *LLNL Authorization Basis Procedure* for further information on nuclear facility categorization.

5.2.2 Category 2 Facilities

In accordance with Table 2, the guidance in all seventeen chapters of DOE-STD-3009-94 shall be used in preparing the DSA and TSRs for a Category 2 nuclear facility. However, the level of detail of the DSA shall be determined according to the graded approach.

5.2.3 Category 3 Facilities

Item 8 of Table 2 allows use of the methods in Chapters 2, 3, 4, and 5 of DOE-STD-3009-94 to address the following in a simplified manner:

- The basic description of the facility (or activity) and its operations, including safety SSCs.
- A qualitative hazards analysis.
- Hazard controls (consisting primarily of inventory limits and safety management programs) and their bases.

For a Category 3 nuclear facility, DOE G 421.1-2, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR Part 830*, allows the methods defined in Chapters 2, 3, 4, and 5 of DOE-STD-3009-94, Change Notice 1 (or successor document) to be used to address the following topics (as applicable) in the DSA and TSRs:

- A description of the facility and its operations, including safety SSCs.
- Process hazards analysis.
- Hazard controls (consisting primarily of inventory limits and safety management programs) and their bases.

For sitewide safety management programs (e.g., radiation protection), the DSA should explain the program features that are important to the facility safety basis and can refer to sitewide program documentation for the details. In addition, it should be noted that DOE G 421.1-2 specifies acceptable methods for meeting 10 CFR 830; alternative methods must be justified.

5.2.4 Detailed Guidance on the DSAs for Category 3 Facilities

This section contains detailed guidance concerning specific chapters of the DSA for Category 3 facilities.

Chapter 1 (Site Characteristics). This chapter should specify the facility's location on the overall site, show the facility boundaries, and identify any other facilities that can significantly impact the facility being examined. This information is frequently derived from the sitewide Environmental Impact Statement or Environmental Impact Report. Onsite meteorological conditions, hydrology, population information, and offsite accident pathways are not typically required, because consequences are limited to the facility itself. Note, however, that if significant chemical hazards are present in a Category 3 facility, more information is necessary.

Chapter 2 (Facility Description). This chapter should provide the facility baseline information for use in all authorization basis development activities. The graded approach is applied, i.e., only the level of detail necessary to understand the hazard analyses in Chapter 3 and other subsequent chapters is provided, usually in the form of a brief description of the facility, activities, operations, processes, and major safety-significant SSCs identified by the hazard analysis in Chapter 3.

Chapter 3 (Hazard and Accident Analyses). Category 3 facilities, by definition, do not have the potential for resulting in significant radiological consequences beyond the immediate facility. The graded approach is significantly dependent on detailed knowledge of the particular activity or set of activities and the associated hazards. The goal of Chapter 3 is to produce a clear, well-reasoned assessment of facility hazards and their associated controls. A comprehensive hazard analysis is considered essential to effectively apply the graded approach. [See *Hazard Analysis Procedure for Category 2 and 3 Nuclear Facilities* (AB-004).]

However, Category 3 facilities do not require an accident analysis for radiological hazards. Instead, a qualitative hazard analysis in Chapter 3 that provides a simple estimate of bounding consequences is sufficient to derive the appropriate controls. Some quantitative analysis may be appropriate if the qualitative consequences are believed to be overly conservative and call for unnecessary controls.

Chemical hazards can also affect the application of the graded approach. Because Category 3 facilities may also have chemical hazards, and because the hazard classification mechanism in DOE-STD-1027-92 does not consider potential hazardous chemical releases, DOE-STD-3009-94 states that the results of hazard analysis will indicate whether a facility contains a significant chemical hazard that may exceed evaluation guidelines, thereby necessitating accident analysis.

Therefore, accident analysis may be needed for toxicological releases, whether or not such releases could trigger nuclear accidents or have nuclear impacts, and may lead to controls for toxicological releases. (This is an application of attribute six, "The relative importance of radiological and nonradiological hazards.")

Chapter 4 (Safety Structures, Systems, and Components). Category 3 facilities do not have safety-class SSCs but may have safety-significant SSCs.

Chapter 5 (Derivation of TSRs). For Category 3 facilities, this chapter may consist only of an inventory limit necessary to maintain the Category 3 classification and appropriate commitments to safety programs discussed in the section on administrative controls. However, TSRs should also state requirements needed to preserve critical assumptions upon which the hazard and accident analysis are based.

Chapter 6 (Prevention of Inadvertent Criticality). This chapter is not generally applicable to Category 3 facilities, which, by definition, should not contain amounts of fissile materials that

present a criticality hazard. Inventory limits in the TSRs must be specified to control the amount of fissile materials. However, if the hazard categorization threshold limits from Table A.1 of DOE-STD-1027-92, Control Notice 1, are modified with refined release fractions, then it may still be appropriate to address criticality concerns and the criticality program in Chapter 6, even for a Category 3 facility.

Chapters 7–17 (Program-specific chapters). For a Category 3 facility, the descriptions may be shorter and simpler than those required for a Category 2 facility. The information is required to satisfy the safe harbor provision in Table 2, Item 8, Sub-item 3. However, the descriptions of a program's safety management should be brief and summarize the major relevant features of programmatic commitments to the safety basis. Specific aspects of the programs that actually contribute to worker safety are addressed in the comprehensive hazard analysis.

5.2.5 Facilities with Limited Operational Life and Facilities to be Deactivated or Transitioned to a Surveillance and Maintenance Mode

For facilities with a limited operational life, or facilities to be deactivated or transitioned to a surveillance and maintenance mode, attribute three (i.e., facility life cycle stage) of the graded approach may be invoked by following DOE-STD-3011-94 instead of DOE-STD-3009. This option is allowed by the safe harbor provision. See items 3 and 4 in the left column of Table 2 (see Section 7.1). Section 7.2 shows how the DSA format specified in DOE-3011-94 [in which the term "basis for interim operation" (BIO) is used] corresponds to that of DOE-STD-3009-94, Change Notice 1.

5.3 Implementation of the Graded Approach Procedure

Facility management personnel responsible for developing, reviewing and approving safety basis documentation must use the current approved version of this procedure to provide appropriate direction in the development of a DSA and other safety basis documents.

6.0 References

1.) *Safety Basis Program Plan for Hazard Category 2 and 3 Nuclear Facilities* (AB-001), August 30, 2001.

2.) Title 10, Code of Federal Regulations, Part 830, "Nuclear Safety Management," Federal Register, Volume 66, Number 7, January 10, 2001.

3.) DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, Change Notice No. 1, January 2000.

4.) DOE G 421.1-2, *Implementation Guide for Use in Developing Documented Safety Analyses to Meet Subpart B of 10 CFR Part 830*, October 24, 2001.

5.) DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, U. S. Department of Energy, November 1994.

6.) *LLNL Nuclear Facility Categorization Procedure* (AB-002) (to be developed).

7.0 Appendices

7.1 Safe Harbor Methodologies in Table 2, Appendix A to Subpart B, 10 CFR 830

TABLE 2

The contractor responsible for * * *	May prepare its documented safety analyses by * * *
(1) A DOE reactor	Using the method in U.S. Nuclear Regulatory Commission Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, or successor document.
(2) A DOE nonreactor nuclear facility	Using the method in DOE–STD–3009, Change Notice No. 1, January 2000, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports, July 1994, or successor document.
(3) A DOE nuclear facility with a limited operational life	Using the method in either: (1) DOE-STD–3009-, Change Notice No. 1, January 2000, or successor document, or (2) DOE-STD–3011–94, Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans, November 1994, or successor document.
(4) The deactivation or the transition surveillance and maintenance of a DOE nuclear facility.	Using the method in either: (1) DOE-STD–3009, Change Notice No. 1, January 2000, or successor document, or (2) DOE-STD–3011–94 or successor document.
(5) The decommissioning of a DOE nuclear facility	(1) Using the method in DOE-STD–1120–98, Integration of Environment, Safety, and Health into Facility Disposition Activities, May 1998, or successor document; (2) Using the provisions in 29 CFR 1910.120 (or 29 CFR 1926.65 for construction activities) for developing Safety and Health Programs, Work Plans, Health and Safety Plans, and Emergency Response Plans to address public safety, as well as worker safety; and (3) Deriving hazard controls based on the Safety and Health Programs, the Work Plans, the Health and Safety Plans, and the Emergency Response Plans.
(6) A DOE environmental restoration activity that involves either work not done within a permanent structure or the decommissioning of a facility with only low-level residual fixed radioactivity.	(1) Using the method in DOE-STD–1120–98 or successor document, and (2) Using the provisions in 29 CFR 1910.120 (or 29 CFR 1926.65 for construction activities) for developing a Safety and Health Program and a site-specific Health and Safety Plan (including elements for Emergency Response Plans, conduct of operations, training and qualifications, and maintenance management).
(7) A DOE nuclear explosive facility and the nuclear explosive operations conducted therein.	Developing its documented safety analysis in two pieces: (1) A Safety Analysis Report for the nuclear facility that considers the generic nuclear explosive operations and is prepared in accordance with DOE-STD–3009, Change Notice No. 1, January 2000, or successor document, and (2) A Hazard Analysis Report for the specific nuclear explosive operations prepared in accordance with DOE-STD–3016–99, Hazards Analysis Reports for Nuclear Explosive Operations, February 1999, or successor document.
(8) A DOE hazard category 3 nonreactor nuclear facility	Using the methods in Chapters 2, 3, 4, and 5 of DOE-STD–3009, Change Notice No. 1, January 2000, or successor document to address in a simplified fashion: (1) The basic description of the facility/activity and its operations, including safety structures, systems, and components; (2) A qualitative hazards analysis; and (3) The hazard controls (consisting primarily of inventory limits and safety management programs) and their bases.
(9) Transportation activities	(1) Preparing a Safety Analysis Report for Packaging in accordance with DOE-O–460.1A, Packaging and Transportation Safety, October 2, 1996, or successor document and (2) Preparing a Transportation Safety Document in accordance with DOE-G–460.1–1, Implementation Guide for Use with DOE O 460.1A, Packaging and Transportation Safety, June 5, 1997, or successor document.
(10) Transportation and onsite transfer of nuclear explosives, nuclear components, Navel nuclear fuel elements, Category I and Category II special nuclear materials, special assemblies, and other materials of national security.	(1) Preparing a Safety Analysis Report for Packaging in accordance with DOE-O–461.1, Packaging and Transportation of Materials of National Security Interest, September 29, 2000, or successor document and (2) Preparing a Transportation Safety Document in accordance with DOE-M–461.1–1, Packaging and Transfer of Materials of National Security Interest Manual, September 29, 2000, or successor document.

7.2 Correspondence Between DOE-STD-3011-94 and DOE-STD-3009-94

BIO Sections per DOE-STD-3011-94	SAR Chapters per DOE-STD-3009-94
Executive Summary Introduction	Executive Summary
Facility Description Relevant Operational History	Site Characteristics Facility Description Safety Structures, Systems, and Components
Safety Management	Prevention of Inadvertent Criticality Radiation Protection Hazardous Material Protection Radioactive and Hazardous Waste Management Initial Testing, In-Service Surveillance, and Maintenance Operational Safety Procedures and Training Human Factors Quality Assurance Emergency Preparedness Program Provisions for Decontamination and Decommissioning Management, Organization, and Institutional Safety Provisions
Safety Analysis	Hazard and Accident Analysis
Operational Controls	Derivation of Technical Safety Requirements